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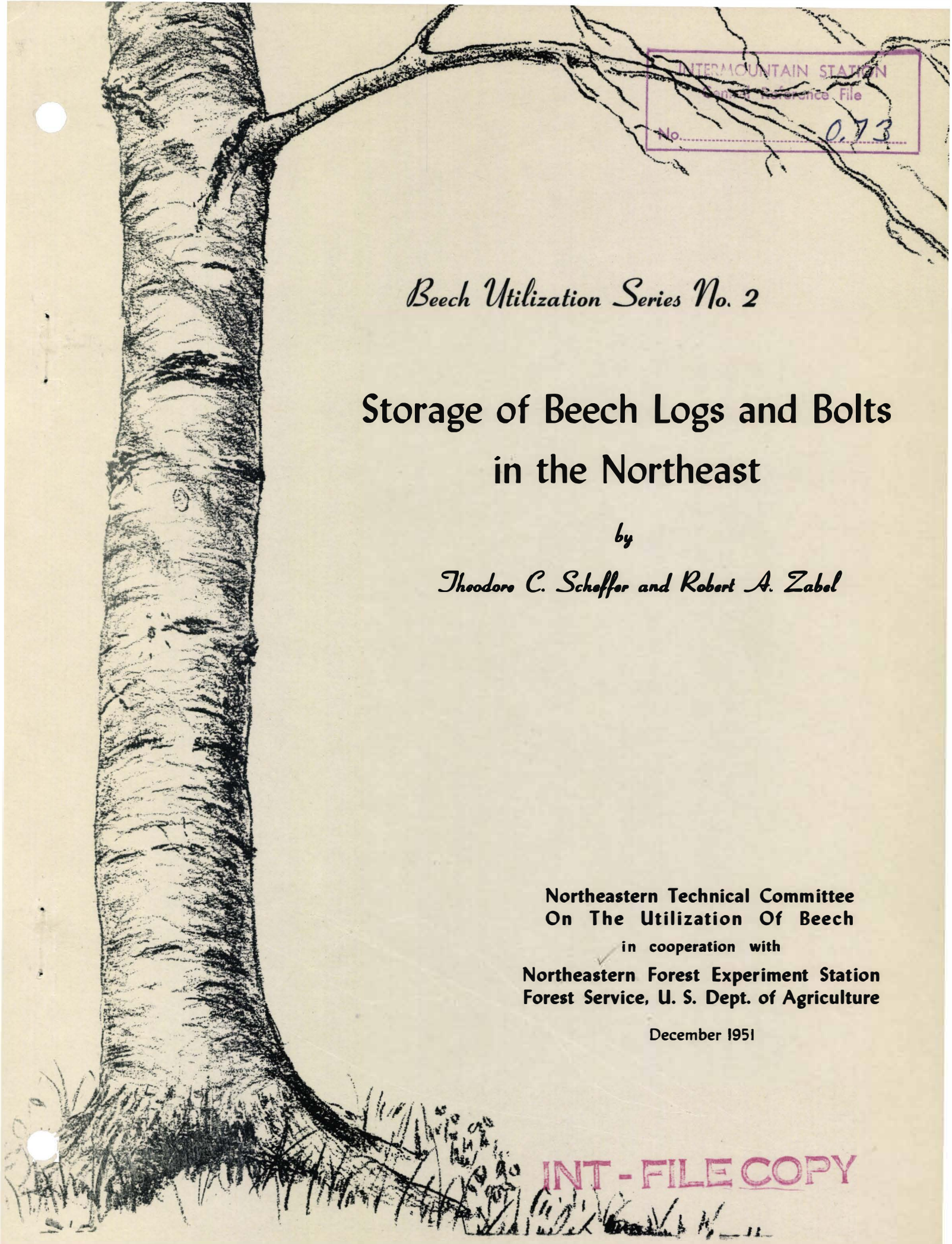

Beech Utilization Series No. 2

Storage of Beech Logs and Bolts in the Northeast

by

Theodore C. Scheffer and Robert A. Zabel

Northeastern Technical Committee
On The Utilization Of Beech
in cooperation with
Northeastern Forest Experiment Station
Forest Service, U. S. Dept. of Agriculture

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FOREWORD

The wood of the American beech tree (Fagus grandifolia Ehrh.) is well suited for a large number of uses, and it is rather widely used by manufacturers. Yet the amount used is not in proportion to the amount that grows in our northeastern forests. The utilization of beech--both in the woods and in the factory--has been recognized as a problem.

One reason for this is in the nature of the wood: it has a reputation for being difficult to season. Another is that many of the beech trees in our forests are of poor quality. And there are some plain prejudices against beech.

Research is finding ways to utilize beech as efficiently as any of the other comparable hardwoods can be handled. Considerable information about beech has been gathered. Yet most of this information is available only in fragmentary form in scattered technical reports. Some of it has never been published.

To study the problems of putting beech to the uses it deserves, and to promote the better management of the forests in which it grows, a Northeastern Technical Committee on the Utilization of Beech was organized in 1949. This committee, which includes representatives of Federal and State forestry agencies, universities, and state experiment stations, decided to assemble and publish the available information about the utilization of American beech.

As its part of this cooperative project, the Northeastern Forest Experiment Station has undertaken to edit, publish, and distribute the series of reports that will contain this information.

The subjects of these reports will be as follows:

* Physical and mechanical properties of American beech.

(CONTINUED ON INSIDE OF BACK COVER)

STORAGE OF BEECH LOGS AND BOLTS IN THE NORTHEAST

by

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ALONG WITH OTHER northeastern hardwoods, beech (Fagus grandifolia Ehrh.) is cut mostly during the cold season from late fall to early spring. Reserve stocks necessary for year-round operation of sawmills and wood-using industries generally are accumulated during this period.

Cutting at other seasons is rather irregular. This is due partly to greater transportation difficulties during prolonged spring thaws, but mainly to custom and preference on the part of the suppliers. A large part of the wood is furnished by timber owners who, because of farm activities or other commitments, have limited time available for cutting and hauling during the warm months.

The long storage periods in the warm weather of late spring, summer, and early fall result in serious losses of usable wood, principally from decay ("dote"; "doze") and

end-checking. In addition, minor storage losses are caused by insect damage and blue stain.

FACTORS OF DECAY IN BEECH

Cause Of Decay

Decay in wood is caused by microscopic, threadlike plants known as fungi, which under favorable conditions of temperature, moisture, and oxygen grow in wood and break it down. The term "wood decay" is used to indicate the changes in the physical and chemical properties of wood that result from fungus activity. Decay is of concern because of the great strength reduction and color changes in the affected wood.

Susceptibility To Decay

There is considerable variation in decay resistance of the heartwood among different species. To cite outstanding instances, heartwood of black locust and of northern white-cedar is very resistant to decay, whereas that of maple, birch, and beech is very susceptible.

Beech in log form is particularly susceptible to fungus infection. For example, 4-foot turning bolts used in the manufacture of clothespins have been observed with advanced decay throughout after 4 months of summer storage (fig. 1).[1] Observations in log-storage yards in the Northeast indicate that unless winter-cut beech logs are utilized before July serious degrade results from decay. Winter-cut logs, stored during summer and sawed in the fall, may be decayed and stained as much as 4 and 5 feet from the ends.

The character of the bark is an important factor in the marked susceptibility of beech logs and bolts. The bark of associated hardwood species such as birch and maple pro-

[1] CARTER, ROY A., HILBORN, M., AND SCHEFFER, T.C. CHEMICAL TREATMENT OF NORTHERN HARDWOOD BOLTS FOR PROTECTION AGAINST DECAY DURING WARM WEATHER STORAGE. U.S. DEPT. AGR., BUR. PLANT INDUS. AND FOREST PROD. LAB. (UNPUBLISHED OFFICE REPORT.) 1949.

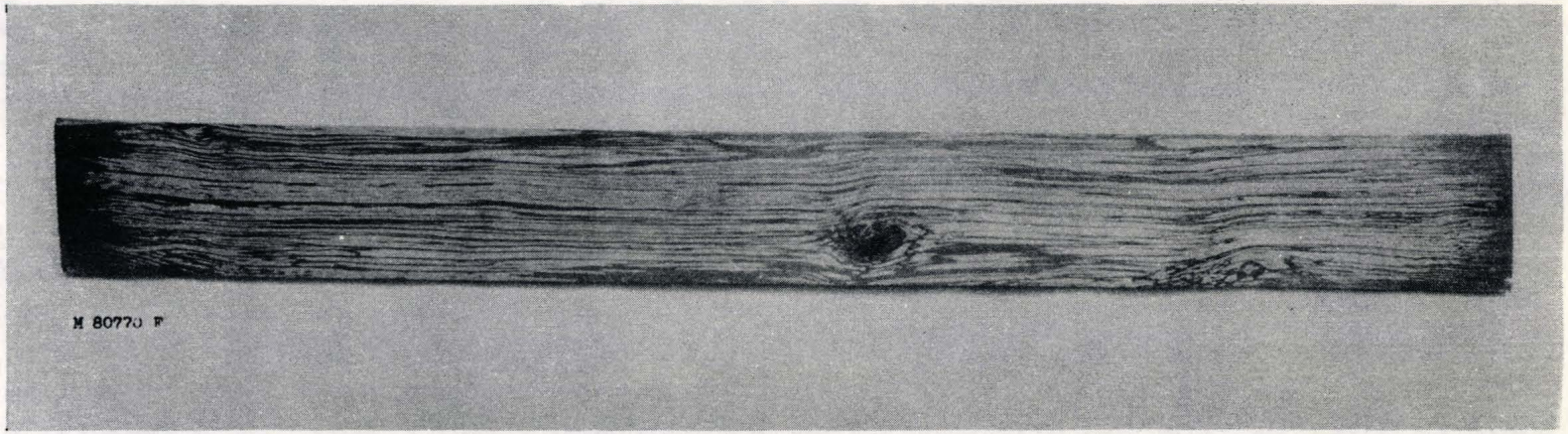

Figure 1.--A section through a beech bolt (4 feet long) that was stored in a pile from June to October. The completely uniform development of decay in the bolt indicates both end and side (penetration of the bark) infections by wood-decaying fungi.

Figure 2.--Beech test bolts (first and third from top) showing 'shelling-off' of bark in patches after a few months of storage in piles.

vides an effective barrier to the entrance of decay fungi for many months. In beech the bark seems to be of little value in this respect. Where sufficiently exposed, it dries out, cracks, and rapidly becomes loose, often tending to "shell off" in patches (fig. 2); this gives decay fungi ready access to the moist wood beneath. Also, the bark itself seems to have only moderate resistance to penetration by decay fungi after the inner bark has dried sufficiently to lose its green color. Consequently, even though the bark remains tight, as it may in the inner portions of a log pile or storage rick, it still provides only limited protection against fungus infection.

Beech sapwood decays somewhat more readily than the heartwood. The difference is not of much practical significance, however, as the heartwood is only slightly more resistant than that of such non-durable woods as aspen and cottonwood; moreover, the volume of beech sapwood generally comprises more than three-fourths of log or bolt volume.

Season Of Cutting In Relation To Decay Resistance

Studies of European beech have indicated that there is no difference in inherent resistance to decay of beech trees felled at different seasons, and that both winter- and summer-felled timber may be attacked with equal readiness.[2]

Logs felled in winter, however, have an opportunity to season somewhat before conditions are favorable for fungus and insect attack; hence winter-cut logs may stain and decay somewhat less than summer-cut logs. Summer is not considered a suitable period for felling beech that has to be stored for any length of time, because excessive splitting and end-checking develop.

Decay Originating In The Living Tree

Certain of the decays in beech logs and bolts may originate in the living tree; these are commonly known as heart rots. Logs with a large proportion of heart rot may not, of course, be worth saving. Those with small to moder-

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[2] CARTWRIGHT, K. ST.G., AND FINDLAY, W.P.K. DECAY OF TIMBER AND ITS PREVENTION. 294 PP., ILLUS. LONDON: H.M. STATIONERY OFFICE. 1946.

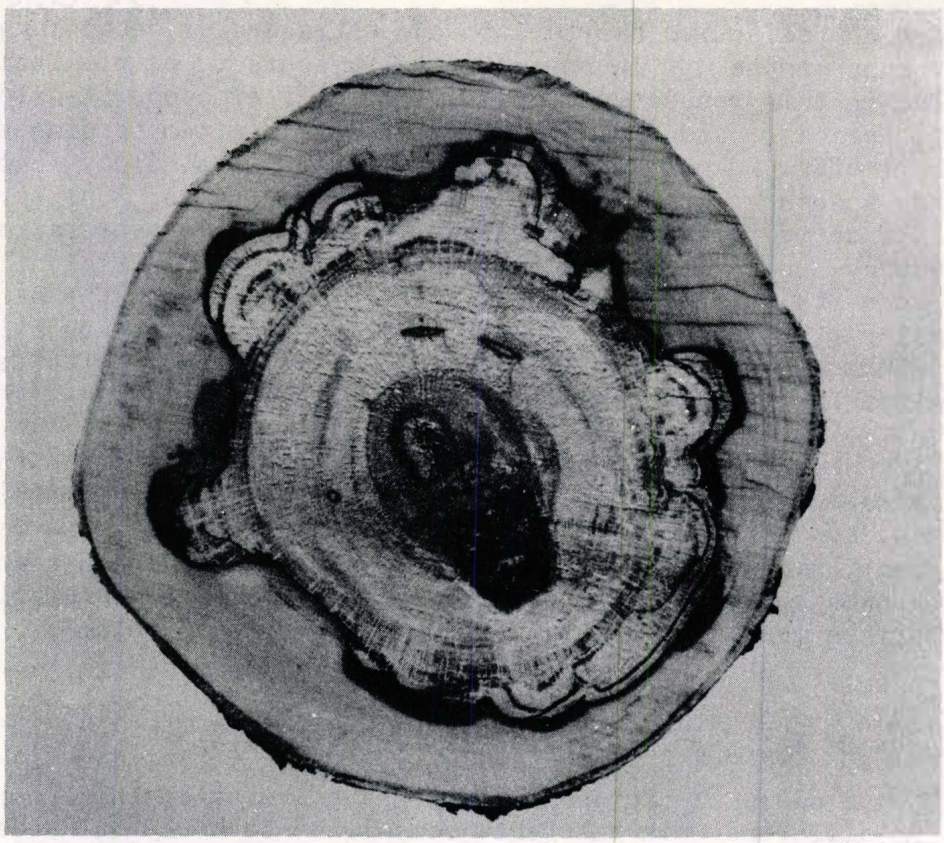

Figure 3.--Freshly cut end of a beech log showing typical discolored area produced by the heart-rot fungus *Fomes igniarius*.

ate amounts might, under some circumstances, be profitably segregated and utilized first, thereby limiting as much as possible spread of the decay into the remaining sound wood.

Heart rot is generally recognized easily by a softening of the wood and by the conspicuous discolorations produced (fig. 3). These discolorations range in shade from dull brown to pale yellow or off-white; they are often intermixed and sometimes interspersed by fine black lines, giving the wood a mottled appearance. The discolored area as seen on the ends of the log is generally more or less centrally located and irregular in outline. Even early stages of heart rot tend to make the wood brash, and thereby to give an abnormally rough saw cut when the logs are bucked.

Advanced heart rot commonly is associated with shelf-like or bracketlike growths on the bark--popularly known as "punks" or "conks" (fig. 4). These are fruit structures of the fungus in the wood beneath. Sterile fruit bodies in the form of clinkerlike masses or brown incrustations in the face of cankers also may be present.

External features of a tree that indicate conditions favorable for heart-rot infection are: old trunk wounds, cankers, frost cracks, frost ribs, and swollen ridges or fluted areas. Conks on the living tree are, of course, definite evidence of heart rot. Average cull to be expected in merchantable northeastern beech extends 4 to 5 feet above and below individual conks.[3] To some extent, needless handling of heart-rotted material can be reduced by paying attention to these features when bucking up the logs.

CONTROL OF DECAY

Natural Controls

During the cold months from late fall to early spring no protection against decay is needed in the Northeast; hence logs or bolts can be safely stored in this period. However, for storage partially or entirely during the warm periods of the year, precautions must be taken if decay is to be avoided or minimized. The need for precautionary measures will depend somewhat on the length of the storage period during warm weather, and on the amount of decay that can be tolerated in the product to be manufactured. Summer-cut logs placed in dry storage must be utilized within a few weeks to avoid serious decay.

The safest plan of control is to utilize beech logs and bolts soon after cutting or to store them in freshwater ponds during warm weather. Pond storage will prevent decay indefinitely and should be considered by wood-using industries located where they can take advantage of it. If logs are kept completely immersed during storage, no discoloration of the wood will result over the longest periods of

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[3] CAMPBELL, W. A., AND SPAULDING, PERLEY. STAND IMPROVEMENT OF NORTHERN HARDWOODS IN RELATION TO DISEASES IN THE NORTHEAST. ALLEGHENY FOREST EXPT. STA. OCCAS. PAPER 5. 25 PP., ILLUS. 1942.

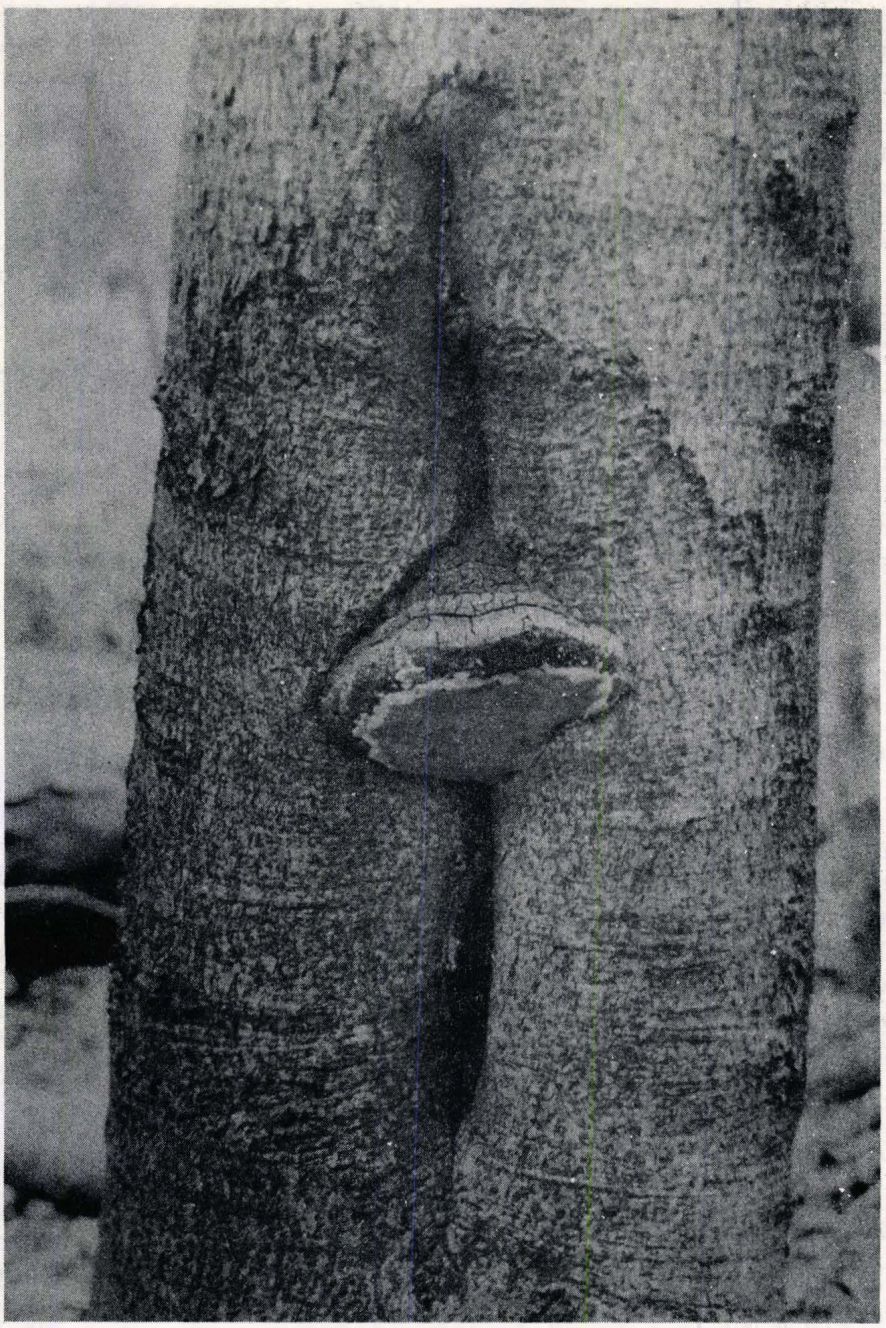

Figure 4.--Fruiting body of *Fomes igniarius* on beech.

storage ordinarily required. The main disadvantages of pond storage are the additional handling costs and the difficulty of recovering "sinkers."

A less reliable method of preventing beech decay, but nevertheless one that has been worth while at the plant where it was observed, is storage under wet hay.[4] At this plant, which manufactures clothespins from a number of hardwoods, the winter-cut bolts are stacked on end and covered with hay in early spring (fig. 5). The hay cover is wet down at frequent intervals throughout the summer.

The bark of beech bolts stored in this way remained tight and the inner bark retained its green color to within a few inches of the upper end of the bolts. The only decay observed in slats cut from these bolts was in this upper portion. The practicability of this method of storage depends on a cheap source of water and hay. Its effectiveness presumably depends in a considerable measure on the care taken to wet the hay frequently during dry weather.

When it is necessary to store beech logs in decks during the warm summer months, early conversion seems to be the only practical way of insuring against serious losses from decay. This conclusion has previously been stressed for beech grown in England.[5] Rapid conversion of beech can be facilitated by placing the logs in piles separate from those of other woods, so that the beech can be used first without excessive handling. Beech logs with early heart rot might profitably be segregated further and used ahead of the sound logs; advantage of this has not been established, however.

Except for the briefest storage periods, the logs should be decked off the ground, on skids.

Chemical Control

It has been found useless to spray the ends of beech bolts with a preservative solution, because of the susceptibility of the bark to fungus penetration.[6] There is little reason to believe that materially better results could be

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[4] SEE FOOTNOTE 1.

[5] FINDLAY, W.P.K. THE PREVENTION OF DECAY IN BEECH. WOOD 7 (2): 37-38, ILLUS. 1942.

[6] SEE FOOTNOTE 1.

had with logs. Spraying of the bark as well as the ends should help some but probably would be economically feasible only with large logs. Moreover, because of the tendency for beech bark to loosen on drying, such treatment might be expected to be only moderately effective at best.

CONTROL OF END-CHECKING

Cause Of End-Checking

Uneven drying and differences in amount of radial and tangential shrinkage of wood often cause the ends of seasoning logs or bolts to check or split. Beech logs are subject to severe damage from such checking, particularly in the heartwood.

Use Of End Coatings

End-checking in beech can be controlled for a few months by application of appropriate coatings to the log ends. Since a rather thick application of the coating material is necessary, ordinary paint is not effective enough.

Two relatively cheap materials suitable for end-coatings are filled hardened gloss oil and thick asphalt preparations. Filled hardened gloss oil, developed at the U. S. Forest Products Laboratory, is suitable for storage periods up to about 4 months. It can be made by local paint and varnish manufacturers. Thick asphalt preparations, either in the water-emulsion or in the cut-back form, appear to be particularly effective over longer periods. Use of the emulsion form is limited to mild weather (above 40° F.), but has the advantage of lower cost. If suitable asphalt coatings are not available locally, they can be obtained from some of the suppliers listed below.

There are a number of relatively cheap end-coatings on the market that have promise of being effective and easy to apply. The following partial list of suppliers is offered with no implication of endorsement:

Akron Paint and Varnish Co., Akron 1, Ohio; Angler Products, Inc., 120 Potter St., Cambridge, Mass.; Barrett Division, Allied Chemical and Dye Corp.,

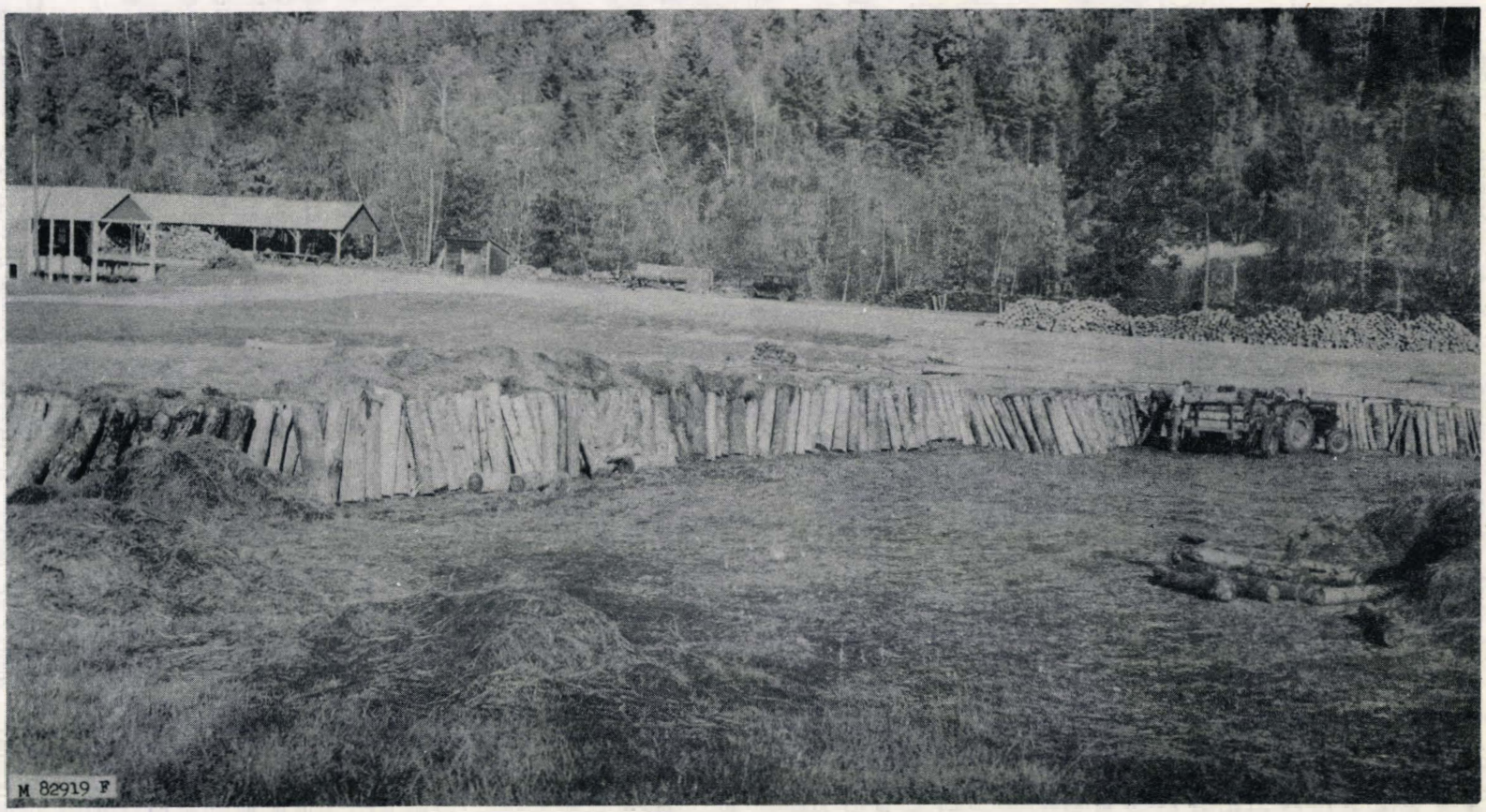

Figure 5.--Storage of beech and other northern hardwood bolts under wet hay.

40 Rector Street, New York 6, N.Y.; Chapman Chemical Co., Memphis, Tenn.; E. I. duPont de Nemours and Co., Finishes Division, Wilmington, Del.; The Flintkote Co., Industrial Products Division, 17th and Wentworth Avenue, Chicago Heights, Ill.; Mautz Paint & Varnish Co., Madison, Wis.; Moore Dry Kiln Co., Jacksonville 1, Fla.; Ohmlac Paint and Refining Co., 6550 S. Central Avenue, Chicago, Ill.; Pittsburgh Plate Glass Co., 235 E. Pittsburgh Avenue, Milwaukee, Wis.; Reilly Tar and Chemical Corp., 1615 Merchants Bank Building, Indianapolis 4, Ind.,; General Industrial Chemicals, 3048 Michigan Drive, Louisville 12, Ky.; and V. M. Cooper & Co., Station C, Box 71, Atlanta, Ga.

The coating may be applied with a stiff brush or by spraying. If cold weather makes application difficult, the material should be warmed. One coat should be sufficient if the preparation is of heavy painting consistency and has good moisture-retarding properties. The ends should be coated soon after the logs are cut, as control of checking becomes difficult after fine checks have developed.

One gallon of end-coating will cover about 70 to 100 square feet of end surface, or, on an average, both ends of about 30 logs, 18 inches in diameter. Assuming a cost of $1 per gallon, the coating needed for 1,000 board feet (log scale) of such logs would cost about 15 to 20 cents. Labor costs of application would be additional.

INSECT DAMAGE AND BLUE STAIN

As a general rule beech logs and bolts stored in the Northeast suffer comparatively little damage from wood-boring beetles or from blue stain. Consequently precautions against these agencies are usually not needed. The New Haven, Conn., Laboratory of the Division of Forest Insect Investigations has no records of serious damage to logs cut from living beech trees; logs from trees already dead or dying when cut may have some borer or pinhole damage in the sapwood.

Lumber sawed from beech logs and air-seasoned during damp summer weather may acquire objectionable amounts of

blue stain. This can be prevented by dipping in a stain-preventive solution.[7]

SUMMARY

In the Northeast, beech logs and bolts are seriously degraded during warm-weather storage by decay or rot, and end-checking, and to a much lesser degree by insect attacks and blue stain.

Control measures against decay are not needed for wood cut and stored during the cold months from late fall until early spring.

Through the remainder of the year decay can be reliably controlled by milling the logs or bolts within a few weeks after cutting or by storing them in water. Prompter milling can be facilitated by storing the beech in piles separate from those used for other woods. The decked logs should be placed off the ground on skids.

Storage under wet hay has proven partially effective but nevertheless worth while for various hardwood bolts including beech.

Chemical control of decay in beech logs by spraying is not satisfactory because of limitations imposed by the bark, which seems to offer little resistance to fungus penetration and tends to loosen rapidly when subjected to drying.

Beech logs need protection against end-checking soon after cutting. Sources of end-coatings to provide this protection are listed.

Protection of beech logs against insect damage and blue stain are generally not needed in the Northeast.

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[7] VERRALL, A.F., AND SCHEFFER, T.C. CONTROL OF STAIN, MOLD, AND DECAY IN GREEN LUMBER AND OTHER WOOD PRODUCTS. FOREST PROD. RES. SOC. PROC. 3: 480-488, ILLUS. 1949.

(CONTINUED FROM INSIDE OF FRONT COVER)

Chemistry and chemical utilization of beech.
Management of beech.
Beech availability and supply.
Present markets and uses for beech.
Methods of logging beech.
Seasoning of beech.
* Storage of beech logs and bolts.
Machining of beech.
Milling of beech.
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Preservative treatment of beech.
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Beech for fuel and charcoal.
Beech for cross ties.
Beech for containers.
Pulping and defiberization of beech.
Rough construction on the farm with beech.

The Northeastern Station acknowledges gratefully the effort being devoted to these problems by the many agencies and individuals who are cooperating in this project. Among the leaders in it are David B. Cook, New York State Conservation Department; Claude Bell, U.S. Forest Products Laboratory; Raymond J. Hoyle, College of Forestry of the University of the State of N. Y.; and Fred Wangaard, Yale University School of Forestry. These men, along with Fred C. Simmons and C. R. Lockard of the Northeastern Station, comprise the "working committee" that is directing and coordinating the project.

The information gathered in this widespread cooperative project should be of great use to the wood-using industries of the regions where the wood of American beech is available.

Ralph W. Marquis

Ralph W. Marquis, Director
Northeastern Forest Experiment Station

*Reports published.